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TECTONIC STRUCTURE OF ALASKA AS EVIDENCED BY ERTS IMAGERY AND ONGOING SEISMICITY

Final Report

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Principal Investigator:

Larry D. Gedney

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

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PREFACE

This report summarizes the accomplishments made under NASA Contract NAS5-20803, "Tectonic Structure of Alaska as Evidenced by ERTS (LANDSAT) Imagery and Ongoing Seismicity." The primary emphasis of the program was to obtain a better understanding of the tectonic processes in effect in Alaska through a combination of earthquake monitoring and mapping, from space imagery, of lineaments of known and suspected tectonic origin. A correlation of earthquake epicenters with lineaments was to be attempted to ascertain which are presently active tectonic features and which are not.

Due to the widely varying incidence of earthquakes over such a broad area, this report will consider the state as being of four parts, partitioning being based on the level of seismicity in each general area and overall structural similarities. The segments are the "main" or south-central part of the state, the northern part, the western part, and the southeastern part. The Aleutian chain was not included in the study.

While this report signals the end of this phase of the program, there is no doubt that the study will continue for years. In certain areas, the seismic instrumentation has not been in place long enough to evaluate the true level of seismicity, (this does not apply to the more earthquake-prone belts which have been instrumented for over ten years). Additionally, it is planned to upgrade some of the mosaics which have already been produced with imagery of a better quality (as regards cloud cover, sun angle, seasonal variations, etc.). Additional imagery of the western part of the state has already been ordered for this purpose. Plans for further studies are now being made. The data will find use for many years to come.

INTRODUCTION

Most Alaskan earthquakes are direct by-products of the processes of sea-floor spreading. As the North Pacific lithospheric plate migrates to the northwest, it underthrusts and is subducted beneath the Aleutian arc structure in much the same manner as is observed in many other trench-arc systems around the world. Alaska is unique, however, in that subduction and resultant earthquakes are not confined to the oceanic portion of the arc, but extend well inland (Fig. 1). Thus, differential movement between continent and oceanic plate occurs along a number of great right lateral faults along the western edge of the North American continent and extending into central Alaska. The Denali and Fairweather faults (Fig. 2) are representative of these features, and their roles are analagous to that played by the San Andreas fault in California. It follows that most earthquakes associated with this family of faults are of crustal origin. They can sometimes be destructive; there was a magnitude 8.6 earthquake near Yakutat in 1899, a magnitude 8.1 earthquake in British Columbia in 1949, and a magnitude 8.0 earthquake near Glacier Bay in 1958. The second (and more prevalent) type of earthquake in Alaska is that which is produced as the Pacific plate underthrusts the continent. This occurs along a line extending up Cook Inlet, inland to a point north of Mt. McKinley (Fig. 3). As stated before, subduction of this nature in a continental environment is unusual, if not unique, being confined to oceanic trench-arc systems in other parts of the world. Due to the nature of the underthrusting, most associated earthquakes are deeper than those arising from lateral offset, and a well-developed, dipping "Benioff zone" can be traced well into south-central Alaska (Fig. 4). The famous Prince William Sound earthquake of 1964 (magnitude 8.5) was a manifestation of this process.*

While a reasonable understanding of earthquakes directly related to the subduction zone is now possible, springing in large part from the relatively recent discoveries relating to plate tectonics, a similar comprehension of Alaska's "other" earthquakes is lagging. The earthquake belt of central interior Alaska extends in a broad area far outside the sharp bend in the Alaska Range marking the "corner" of the downgoing plate. Presumably, these are due to outwardly-directed stresses arising from plate interaction at the corner. But precisely how this is occurring, and how it is effecting (and has effected) crustal deformation in the Alaskan interior is largely unknown.

A principal thrust of the present investigation was to unravel these questions. It was hoped that, by comparing recently obtained patterns of seismic activity with lineaments possibly representing faults along which offset has occurred recently or in the past, an overall view of tectonic deformation might be obtained for the state as a whole. The seismic data were to be made available by the University of Alaska seismographic net which has been in operation since 1968. Space imagery from LANDSAT (ERTS) I and II was to provide for the mapping of lineaments. This seemed to be a logical testing ground for such a program, since it was known that practically all earthquakes on the

*The Prince William Sound earthquake, however, was of shallow origin, occurring near the top of the focal zone.

"outside" of the bend in the Alaska Range and the Denali fault were of shallow origin, and were thus more likely to show surficial effects (faults) which might be detected on the satellite imagery.

As a beginning, a plot of all earthquakes occurring during a four year period within the major seismic zone of the Alaskan interior was drawn up. An overlay of "known", or mapped faults was then prepared and the results compared. The resulting map is shown as Figure 5. Lineal zones and clusters of epicenters are immediately apparent, in some cases associated with features which were not, but have since been, "officially" recognized as faults. Such a feature is the striking linear shown striking N-S in the northwest quadrant of Figure 6. Previously unnamed, this lineament was the site of a magnitude 6.5 earthquake in 1968, and is now known as the Minook Creek fault. The aftershock sequence and its outline is clearly seen in Figures 1 and 5 (near 65.5°N, 150.0°W). For comparison, a striking LANDSAT view of the Denali fault and Mt. McKinley is shown in Figure 7. This is in the area of what we have come to term the "McKinley Corner", marking the edge of the subducted slab.*

The clarity with which we could identify such features on the satellite imagery led us to attempt the exploration of other areas of the state. This required additional seismic instrumentation which has been, happily, provided for by other agencies. Correlation of the satellite imagery with the new seismic data being obtained is still in the initial stages, mainly because it will take a period of years to record and locate enough earthquakes in the less earthquake-prone areas to draw any positive (or negative) conclusions.

*As an aside, we have come to accredit the very existence of Mt. McKinley and its neighboring high mountains as a product of accretion on the continental margin due to underthrusting of the Pacific plate.

In the meantime, we are certain that we have obtained some positive correlations, and these are outlined in the sections that follow. We begin with the "known" seismic zone of central and south-central Alaska.

TECTONIC STRUCTURE AND SEISMICITY

Central and south-central Alaska

Central and south-central Alaska were the primary focal areas of the present study for two reasons: This is where most Alaskan earthquakes occur (exclusive of the Aleutians), and this is where most of the people live. Study of the surrounding areas is of value in a more esoteric sense, providing information on the state's past deformational history and how it relates to the present.

During an earlier contract period (NAS5-21833), findings were reported regarding the apparent relationships between lineaments and epicenters in the more populated areas of the state. The final report for that contract states these in some detail, and an account appears in the February, 1974 issue of GEOTIMES. Briefly stated, it appeared that a positive correlation could be drawn between many remotely sensed lineaments and actual earthquake epicenters. In at least three cases, a lineament first brought to light by the imagery has since been confirmed as being a genuine fault on the ground. One of the more striking correlations was that the larger earthquakes in the central interior portion of the state consistently fell at intersections of lineaments.

This section of this report concerns itself with a much larger area of central and south-central Alaska which contains nearly all the "continental" earthquakes plotted in Figure 1.

Figure 8 is a LANDSAT mosaic prepared from over 80 images which encompasses the main seismic zone. Most images were acquired during the Fall, Winter, and Spring months because of shadow enhancement during periods of low sun angle. Independently, two investigators made overlays of lineaments which they felt may be of tectonic origin (as opposed to those arising from erosion, bedding, etc.). Selection included the criteria that the lineament be longer than 8 km, and, in questionable cases, that it cross a drainage divide. When the two investigators completed this analysis, the plots were compared, and the lineaments on which both concurred were made into a single overlay. This is shown as Figure 9. Initially, the most striking things seen in the mosaic and on the overlay are the four large, curving faults striking across the area from east to west. These are (from north to south) the Kobuk, the Tintina-Kaltag, the Denali-Totschunda-Fairweather, and the Lake Clark-Castle Mountain fault systems. All are well documented in the field. On closer inspection, similarities other than the faults' general configurations appear. These include the intersection of the Tintina and Denali fault from the southwest by the Teslin and Toschunda, respectively, and the branching off of strong lineaments to the southwest from the three southermost of the principal faults. Figure 10 illustrates these features, along with another which is most striking of all -- the appearance of what seem to be conjugate fracture systems near the area of greatest bend between each of the major faults (the Minook Creek fault shown in Figure 6 is a member of the center set of fractures shown within the circles on Figure 10). In each case, the angle of maximum compression indicated by the orientation of the fractures is NW-SE, approximately orthogonal to the major faults. Characteristic strike directions of lineaments within each of these zones is depicted in Figure 11. The data shown included measurements of 101 lineaments in the northernmost area, 134 in the central one, and 427 in the southernmost. The implication is that sharp bends in a major fault system become centers of compression, and that radial stress fields centered at the bends generate the conjugate sets of fractures. Moreover, present day seismicity suggests that offset along the major fault systems has been sequentially transferred from north to south, because earthquake activity increases in both frequency and magnitude in that direction. Supporting this hypothesis is a significant body of field evidence indicating that most recent lateral offset has occurred on the faults to the south, and the earliest on those in the north, (a more complete treatment and pertinent references are given in the Progress Report dated April 4, 1975, and in the related article appearing in Utah Geological Association Publication #5).

To recapitulate, patterns of earthquake activity in the major seismic belt of Alaska appear to be dominated by two characteristics relating to plate migration. The first of these is the subduction of the north Pacific plate along a line extending from Cook Inlet northward into the Alaskan interior. The second is lateral offset on a series of great faults along which differential movement is, and has been, occurring between the Pacific and continental plates. Finally, the evidence seems to indicate that the subduction zone and related offset on the major fault zones has migrated southward over a large interval of geologic time.

Southeast Alaska

As pointed out, southeast Alaska has experienced a number of great earthquakes during the past century. It would appear from Figure 1 that the level of seismic activity there is actually rather low, but the true picture is difficult to assess because of an insufficiency of seismic instrumentation in this part of the state. The great earthquakes that happen here suggest that there are actually very many smaller events that go undetected.

Figure 12 is a 20-image LANDSAT mosaic of this area of the state. The Fairweather fault (Figure 2), principal earthquake-producing element of the region (Figure 1), lies offshore and cannot be seen on the mosaic. However, many other striking structural features of the area show to great advantage. Principal among these are the Chatham Strait and southern Border Ranges faults. Figure 13 points out the locations of these features. The Chatham Strait fault is thought to be a southern splay of the Denali. From the imagery, it appears to divide the area of the mosaic into two areas exhibiting markedly different tectonic grains. East of the fault, a great many sub-parallel lineaments can be seen striking nearly due N-S. West of the fault, an equal proliferation of lineaments strike NW-SE. With the exception of the Border Ranges fault, and a few other minor features, none of these are mapped faults.

It is difficult to associate the diffuse seismicity shown in Figure 1 to any particular fault or lineament shown on the mosaic. As stated previously, the inadequacy of seismic instrumentation is probably a contributing factor to this, preventing the location of many smaller earthquakes which might, if plotted, point out lineal zones or clusters of epicenters.

While the University of Alaska operates no seismographic installations in southeast Alaska, other remote areas of the state have recently been instrumented. The following sections discuss these areas.

Northern Alaska

During the past year, the University of Alaska installed nine new seismographic stations in the northeast part of the state (Figure 12, single open circles). Together with the basic net, these have permitted the location of a number of earthquakes which would previously have gone undetected (or at least unlocated).

The northern part of the state is (in part) an extremely rugged area, dominated by the Brooks Range. North from here to the coast lies a level or gently undulating region known as the North Slope. Figure 15 is a LANDSAT mosaic showing these features.

The geology of the Brooks Range is extremely complex. The dominant east-west structural grain is controlled by large overthrust faults (overthrusting from south to north) giving way to an anticline-syncline complex north of the range. The thrust faults are easily identifiable on the imagery, while the folds show to best advantage just north of the range in the western part of the mosaic.

Earthquakes located since installation of the new equipment are indicated on Figure 16. There is evidence from fault plane solutions that these are the product of continuing overthrusting in the zone of most intense deformation, although the identification of specific faults on which movement may be occurring would be highly speculative. The driving mechanism for such overthrusting is obscure at the present. It seems unlikely that it could be related to stresses arising in the zone of plate interaction 400 miles to the south. The accumulation of further seismic data will probably aid in the resolution of a regional stress pattern.

Western Alaska

Seismic instrumentation of western Alaska (double open circles on Figure 14) was only recently completed (September, 1976), and epicentral data is not yet available to compare with the imagery. In any event, the mosaic which has been completed (Figure 17) is of inferior quality and does not include the Seward Peninsula. New imagery with which to correct this situation is now on order.

The area of Figure 17 is thought to be largely aseismic, but it has not always been so, as a number of identifiable faults testify. Principal among these are the Denali fault, which experiences little or no seismic activity west of Mt. McKinley. It is recognizable in Figure 18, crossing the scene from center right to lower left, truncating the Triassic sedimentary rocks at bottom left center. This area is characterized by eroded plutons of roughly circular shape, which contrast sharply in this false color image with the surrounding vegetation. The very dark, irregular areas in the upper half of the figure mark recent forest fire burns.

Figure 19, taken south of the previous image, shows the Denali fault striking nearly north-south from the top left center to the lower left center. The sharpness of the feature belies the fact that seismic activity is not thought to be occurring along it. None of the epicenters shown in Figure 1 fall within the boundaries of these two false color images. A key to their locations and the Denali fault is given as Figure 20.

OTHER RESULTS

During the course of the investigation, a number of peripheral studies were undertaken. Several of these deserve mentioning.

It was noted earlier that at least three "new" faults are thought to have been found. One of these, since confirmed, is the Susitna fault in the Talkeetna Mountains of south-central Alaska, (this is the easternmost of the two lineaments trending off the bend in the Denali fault in Figure 10). It merits discussion for a number of reasons. The first of these is that plans are being made for the construction of two large hydroelectric projects near the fault. The fault itself is seismically active (having been the site of four earthquakes in the magnitude 5 range during the last five years), and it has been established that crustal loading due to the impoundment of water in large reservoirs nearly always leads to increased seismic activity in the region. The Susitna fault would cross the river just upstream from the lowermost proposed dam site.

We were approached, during the past year, by the U.S. Army Corps of Engineers to perform a study of the proposed dam sites and provide a quantitive estimate on the factors of seismic risk. We were to utilize data from our seismographic net, LANDSAT imagery, and side-looking radar imagery which they were to provide. The longer and stronger lineaments (including the Susitna fault) were picked from the satellite imagery, while lesser lineaments were plotted from the SLAR data. The imagery showed a dominant tectonic grain in the NE-SW direction (paralleling the Susitna fault) which the SLAR data confirmed, with secondary, shorter lineaments trending nearly at right angles. Data obtained for 368 of the lesser lineaments are summarized graphically in Figure 21. It is significant that very few lineaments trend in an east-west direction. Since this is the course generally followed by the Susitna River, it thus appears that there is little chance that the river itself is fault-controlled. This report is being utilized by the Corps of Engineers in their planning for this important energy project.

The Susitna fault bears further mentioning for an altogether different reason. Since it is truncated by the Denali fault, a search was made of the imagery for its counterpart on the other side of the Denali. It is believed to have been found in the Yukon Territory. Potassium-argon age dating performed by Donald Turner of the Geophysical Institute finds equivalent ages to either side of the Susitna fault and its counterpart; the two segments, though offset, are parallel and are structurally similar. If they were actually once contiguous, the finding is that the Denali fault has undergone 400 km of right-lateral offset during the past 60 million years. This is an altogether reasonable conclusion.

Other seismically active faults indicated by the imagery are the Minook Creek fault mentioned earlier (magnitude 6.5 earthquake in 1968) and an as-yet unnamed fault passing south of Fairbanks. The "Fairbanks fault", for lack of a better term, extends from the town of Nenana northeastward past Fairbanks and into the headwaters of the Chena River. It is indicated on Figures 9 and 10 (it is the uppermost of the two lineaments trending off the Tintina fault in Figure 10) and has been the site of a great deal of seismic activity for the past 10 years (several magnitude 6 earthquakes in 1967). Felt earthquakes occur regularly, with the most recent flurry being in April, 1976 (Figure 22). Isolated felt events have occurred as recently as September 26, 1976. The "Fairbanks fault" has only recently been confirmed in the field on the basis of matching rock types (F. Weber, U.S. Geological Survey).

COST EFFECTIVENESS

It is clear that detailed geologic mapping in an area as large, remote, and inacessible as Alaska would be a staggering task is undertaken by ground survey. Mapping of the state is presently largely vague or incomplete.* Equally obvious is the fact that generally some ground truth is essential, whether it be for age dating, rock classification, measurement of scarp heights, or any of hundred reasons. This is to say that the two methods should not be mutually exclusive, but should complement each other, just as airborne observations should be assimilated, (as with the case of using LANDSAT and SLAR data to complement each other in the case of the Susitna project). For the purposes of this project, it has been found that the expense of trying to analyze an area as large as Alaska utilyzing airborne data alone would be prohibitive (this was discussed in the final report for contract NSA5-21833). In addition, it was the primary goal of the present project to obtain a

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*As an example, the "Triassic sediments" mentioned earlier as being truncated by the Denali fault do not even appear on recent geological maps. They are called Triassic sediments here because they are similar in appearance to other outcrops in the area which <u>have</u> been mapped as Triassic sediments.

large-scale, overall view of Alaskan tectonics. Utilyzing airborne photography to obtain equal coverage at an equal scale would be a senseless waste. However, when greater detail is desired in a particular area of interest (as in the Talkeetna Mountains-Susitna River area) airborne observations then become a vital tool. It is the goal of the project that determines which method is the most cost-effective. In the present case, the desirable (and nearly essential) method is obtaining the data by satellite. Spot checks by ground survey are highly desirable (and have been used in this project in the form of published geologic maps), while aircraft data should be used only when the information needed in a relatively confined area is so fine in detail that it cannot be obtained by satellite.

PUBLICATIONS

Gedney, Larry and James VanWormer, Tectonic lineaments and plate tectonics in south-central Alaska, First International Symposium on the New Basement Tectonics, University of Utah Press, Utah Geological Association, NO. 5, 1975.

Gedney, Larry and Lewis Shapiro, Structural lineaments, seismicity and geology of the Talkeetna Mountains area, Alaska, prepared for the U.S. Army Corps of Engineers, Alaska Division, Anchorage, Alaska, September 1975.

VanWormer, James, Larry Gedney, John Davies and Nicki Condal, Vp/Vs and b-values: a test of the dilatancy model for earthquake precursors, Geophysical Research Letters, V. 2, No. 11, 514-516, November 1975.

Miller, J. M., A. E. Belon, L. D. Gedney and L. H. Shapiro, A look at Alaskan resources with LANDSAT data, Proceedings of the 10th International Symposium on Report Sensing of Environment, University of Michigan, Ann Arbor, Michigan, November 1975.

VanWormer, J. D., J. Davies and L. Gedney, Seismicity and plate tectonics in south central Alaska, Bull. Seism. Soc. Am., 65, 1467-1476, 1974.

EARTHQUAKES IN AND NEAR ALASKA (THRU 1974)

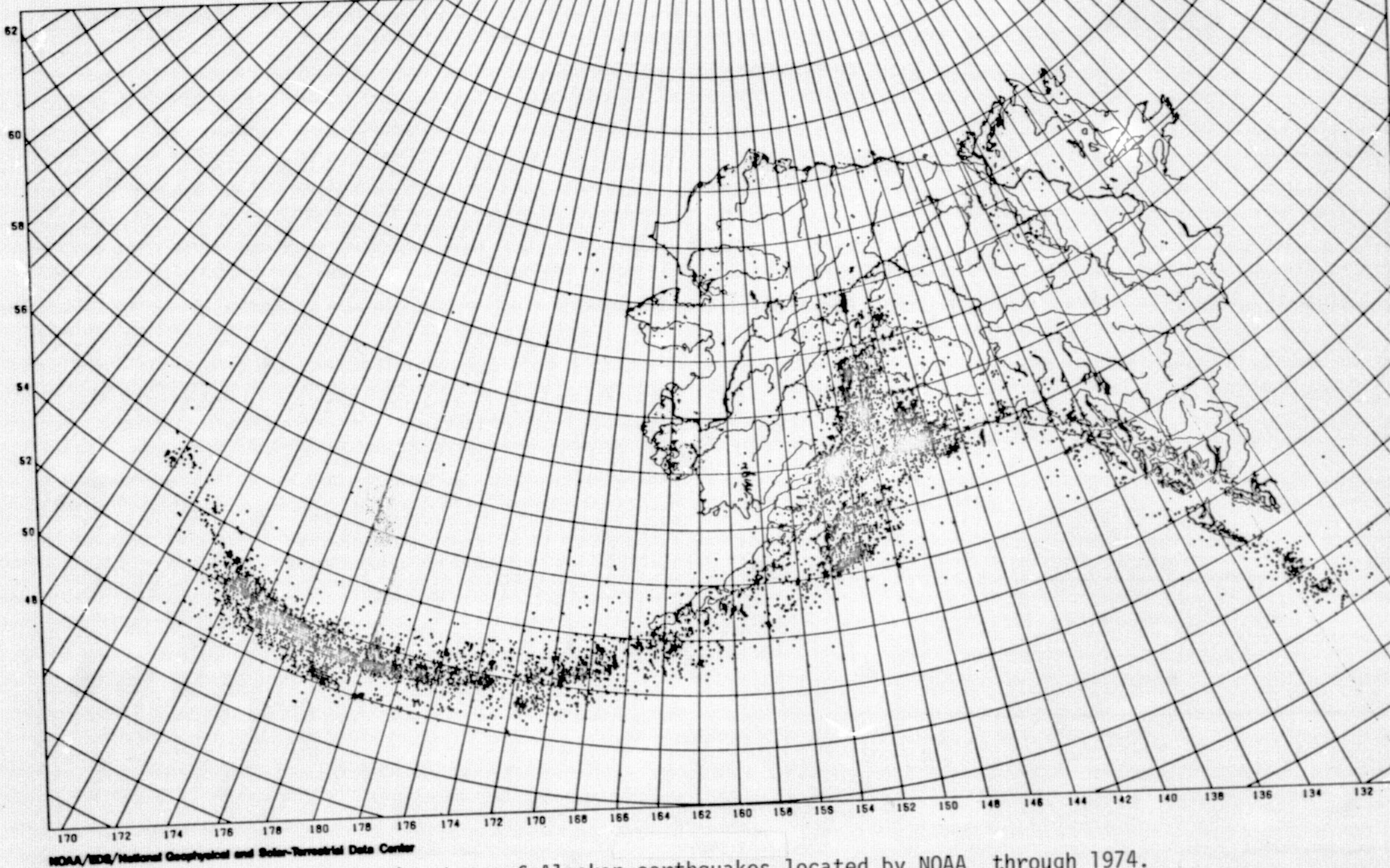

Figure 1. Map showing epicenters of Alaskan earthquakes located by NOAA through 1974.

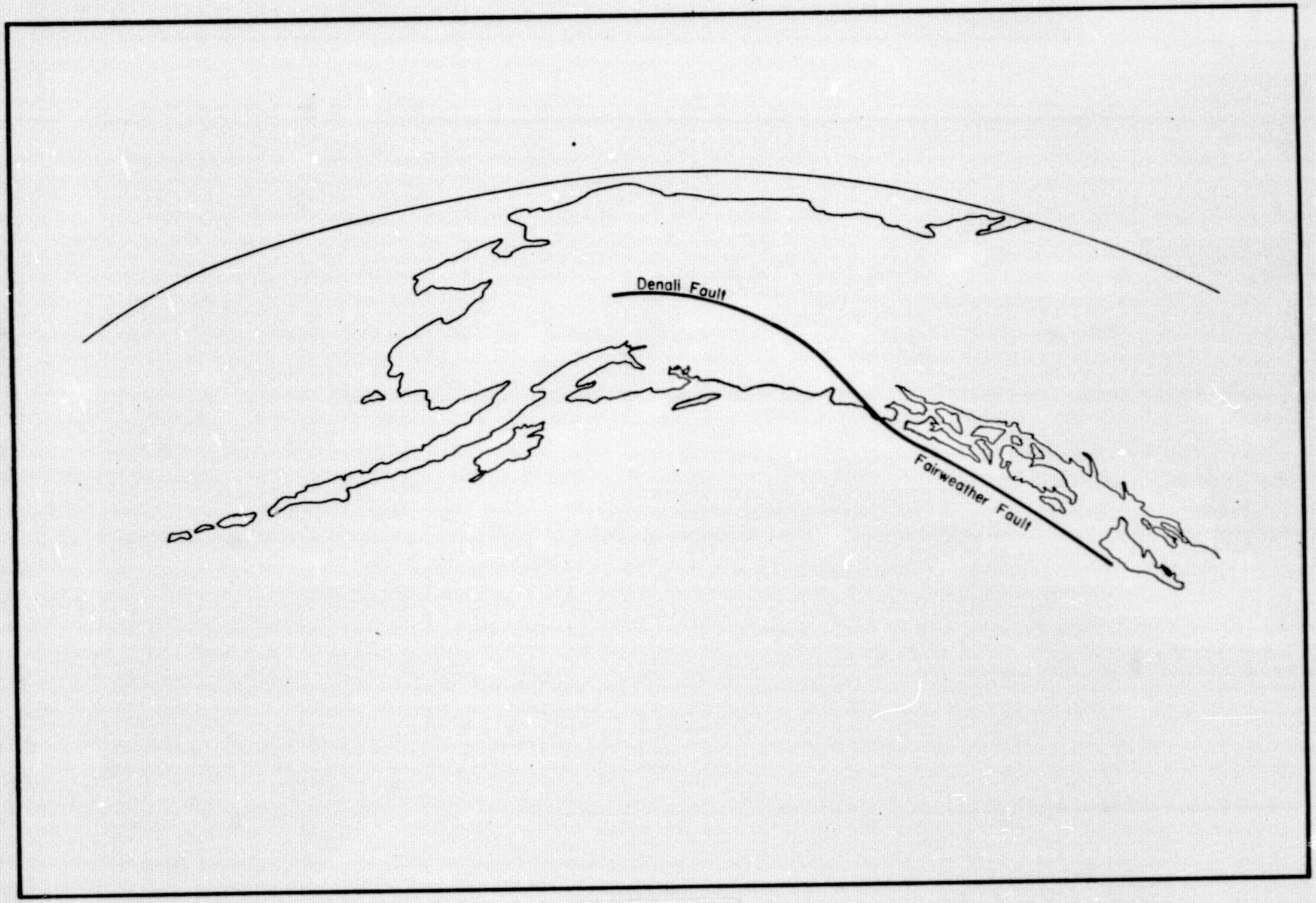

Figure 2. Rough representation of the relationship of the Denali and Fairweather faults to the Pacific margin of North America. The actual situation is not so simple, there being a number of interrelated faults in the area, including the Totschunda faults.

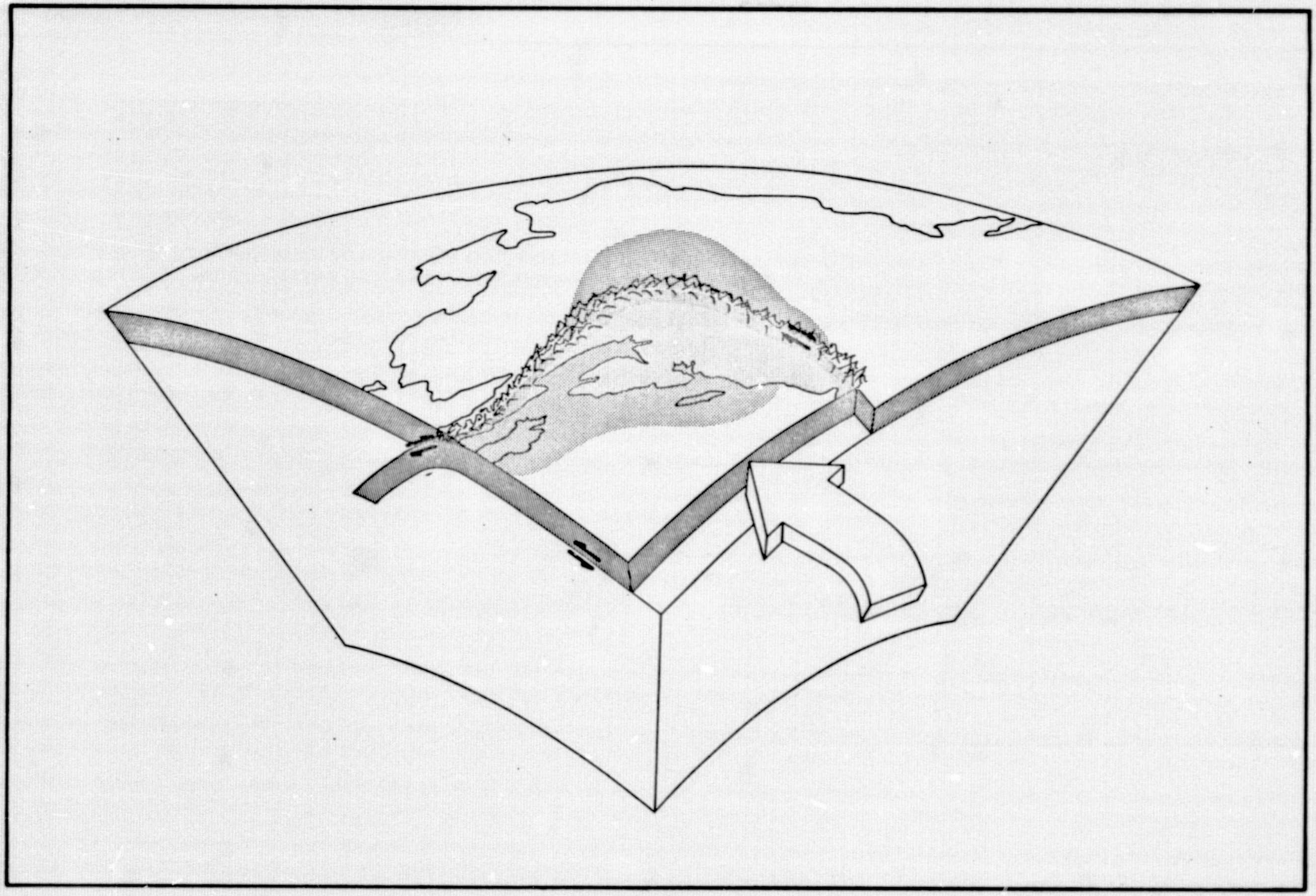

Figure 3. Schematic reflecting the manner in which the crust of the northwest Pacific is being underthrust beneath south-central Alaska. The shaded area includes the most seismically active area of the state surrounding the zone of plate interaction.

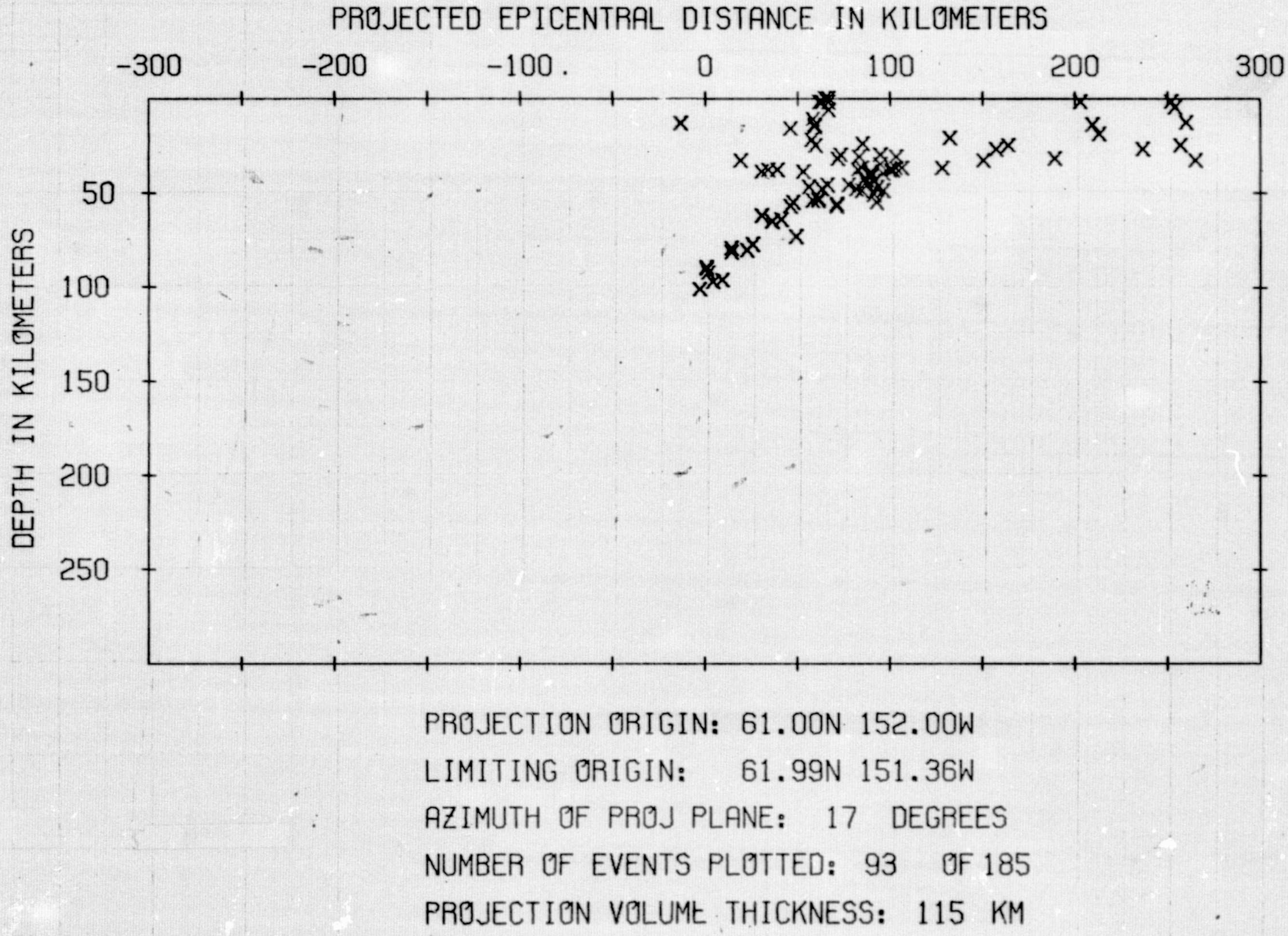

Figure 4. Cross section, 115 km thick, showing dipping zone of earthquake hypocenters beneath the western Alaska Range. View is to the NNW (17°). Data are from University of Alaska files.

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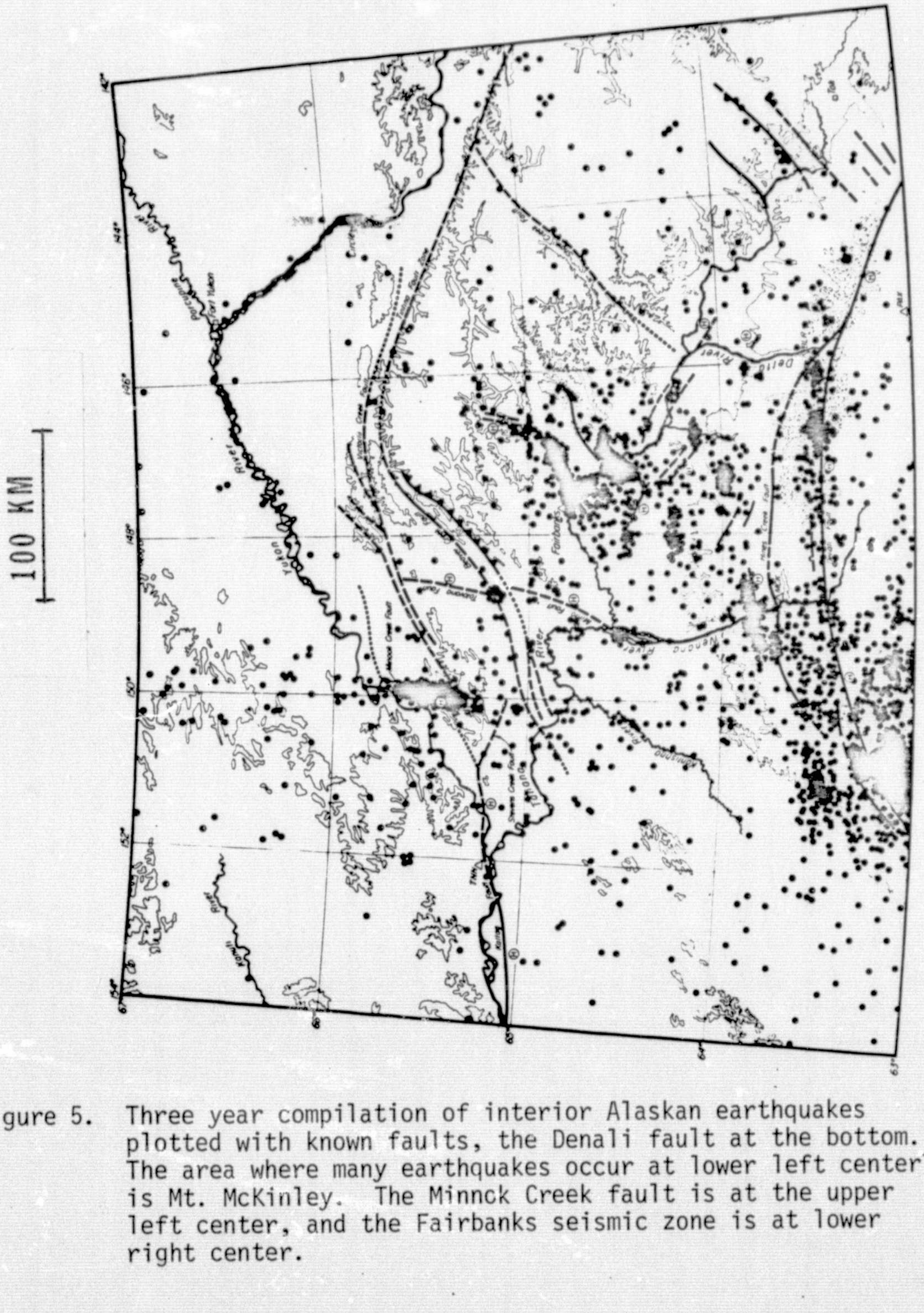


Figure 5. Three year compilation of interior Alaskan earthquakes plotted with known faults, the Denali fault at the bottom. The area where many earthquakes occur at lower left center is Mt. McKinley. The Minnck Creek fault is at the upper left center, and the Fairbanks seismic zone is at lower right center.

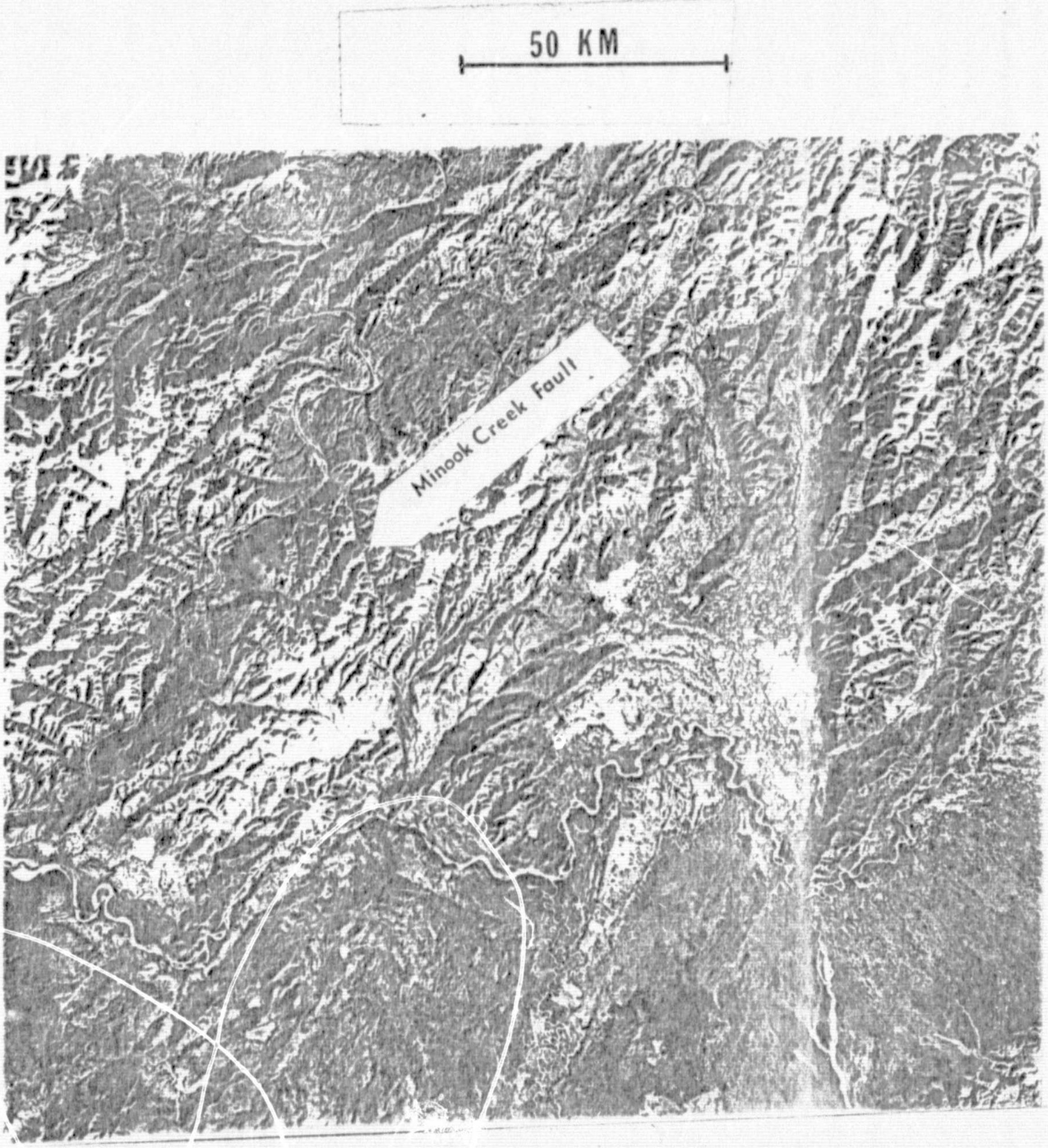


Figure 6. Single LANDSAT frame showing the Minook Creek fault at left center.

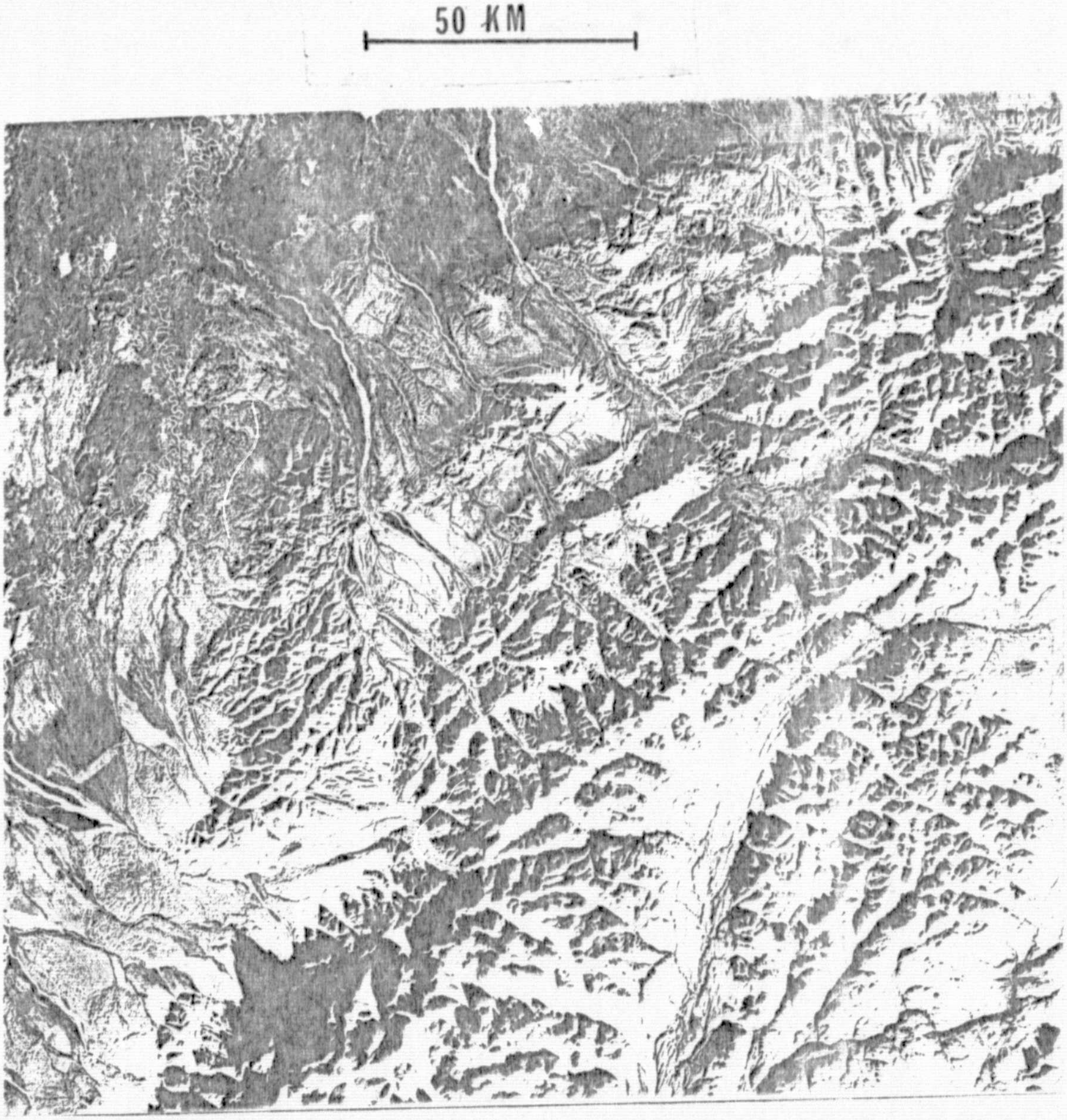


Figure 7. Single LANDSAT frame showing the Denali fault passing from right center and disappearing into the shadow of Mt. McKinley at lower left center.

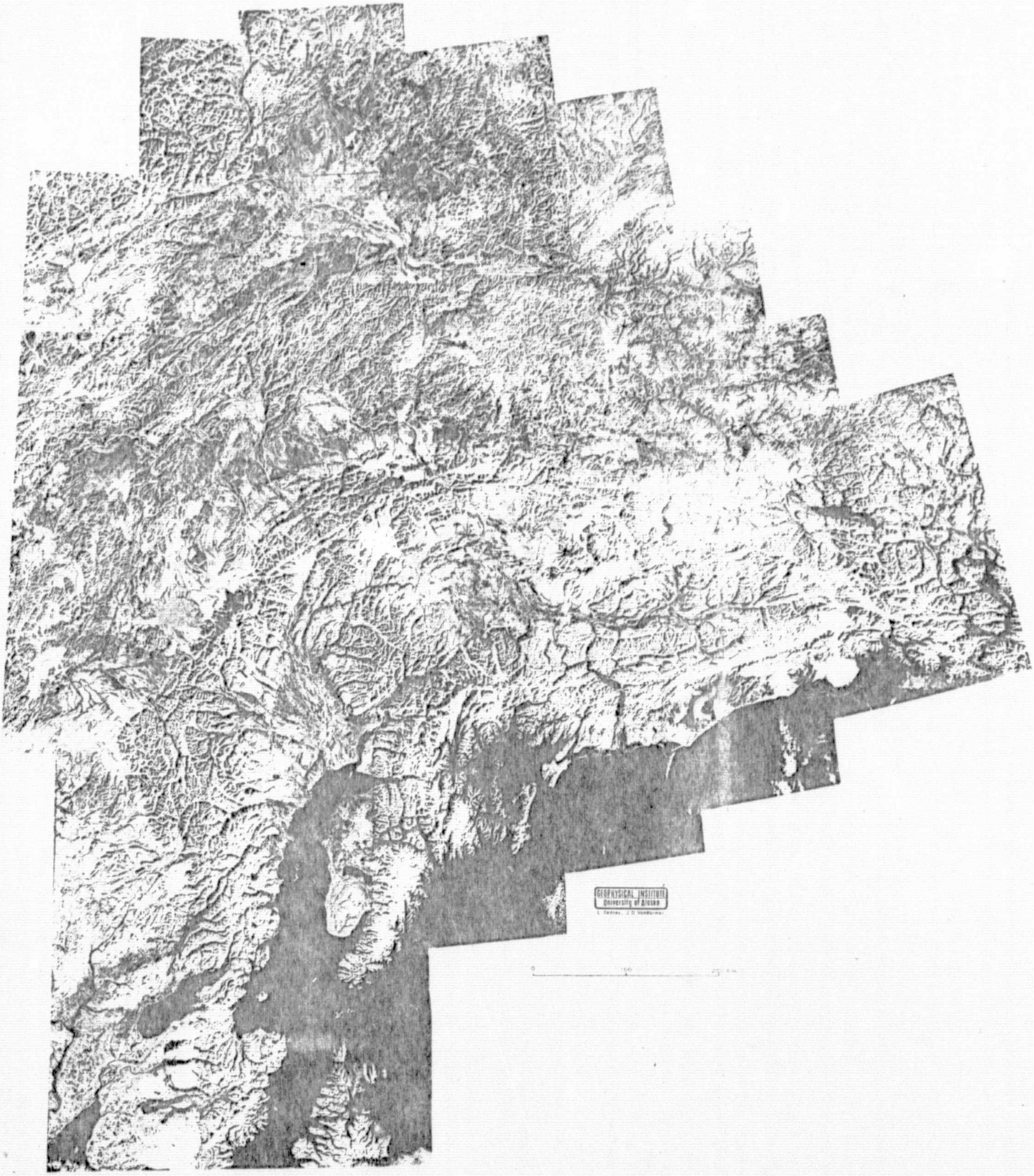


Figure 8. LANDSAT mosaic of the principal seismic zone of central and south-central Alaska.

Figure 9. Lineaments picked (at an original scale of 1:1,000,000) from the mosaic shown in Figure 8.

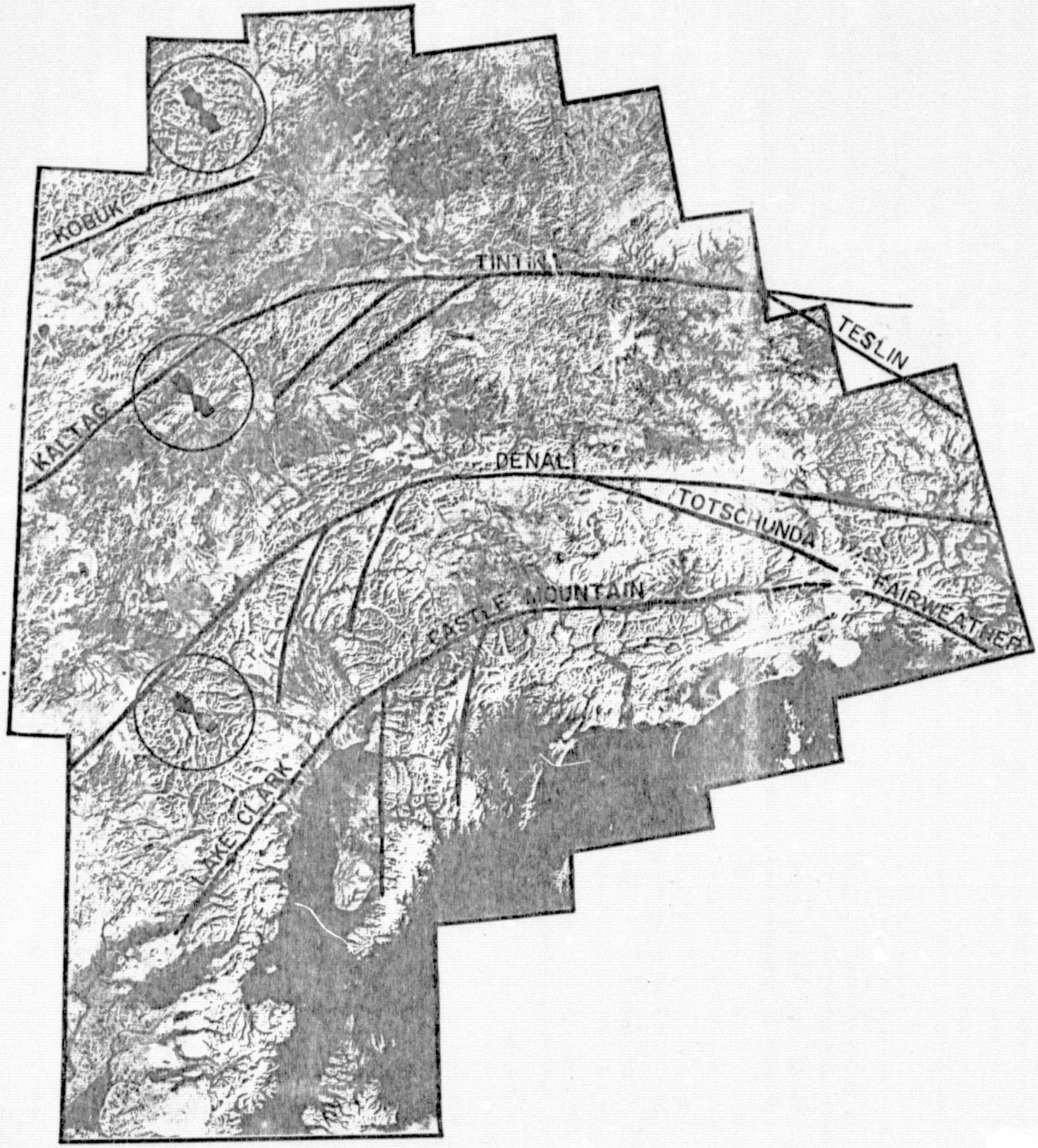


Figure 10. Key to Figure 8 showing principal faults and structural features. The areas within the circles contain what appear to be conjugate fracture systems with directions of maximum compressive stress indicated by arrows.

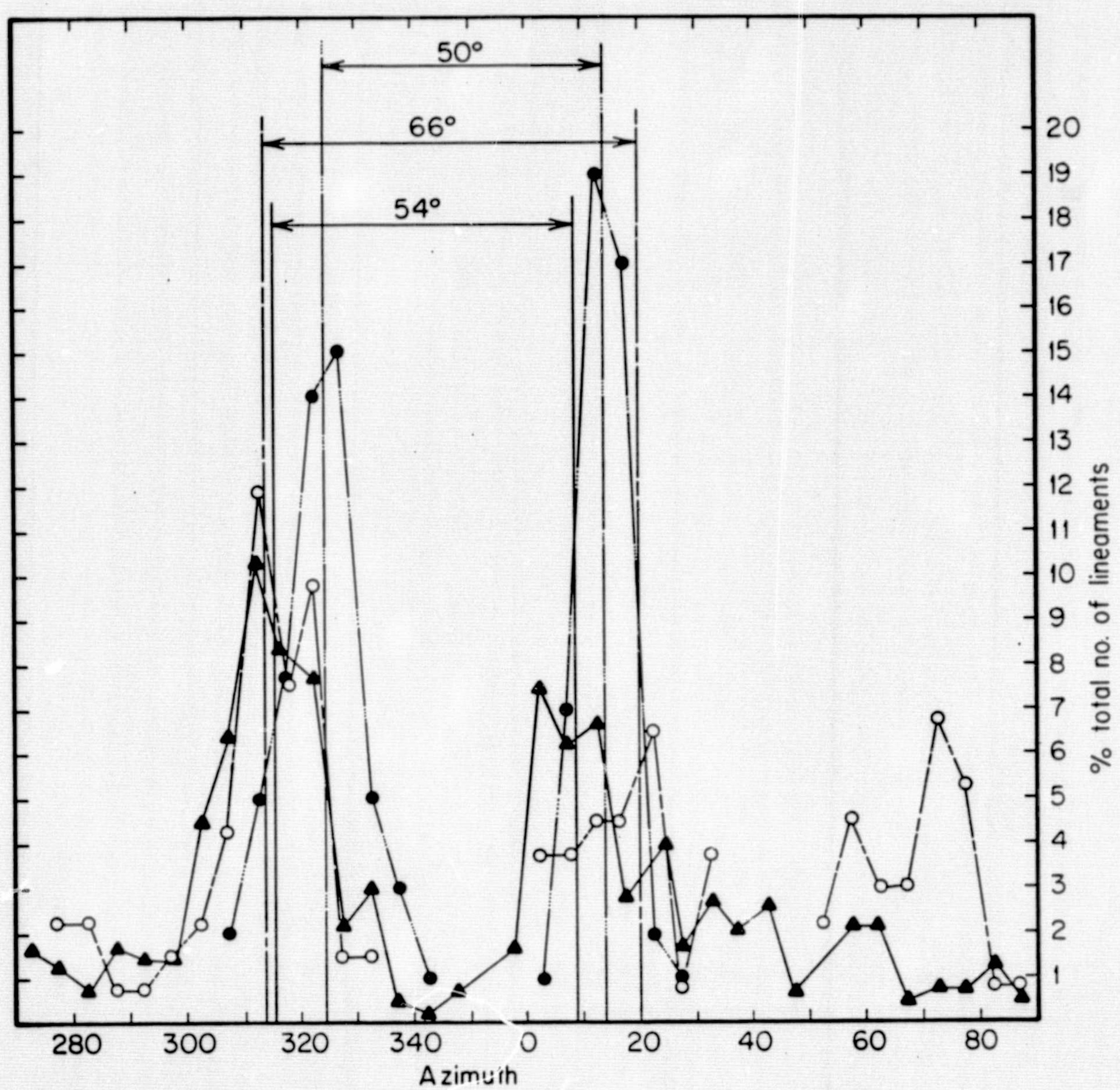


Figure 11. Histogram reflecting characteristic strike directions of lineaments within the three areas circled in Figure 10. From the north, these are the southern Brooks Range (solid circles, 101 lineaments), the Rampart-Ray Mountains complex (open circles, 134 lineaments), and the western Alaska Range (solid triangels, 427 lineaments). The additional peak in the Rampart-Ray Mountains plot at around 70°-80° reflects the Kaltag fault and associated parallel lineaments.

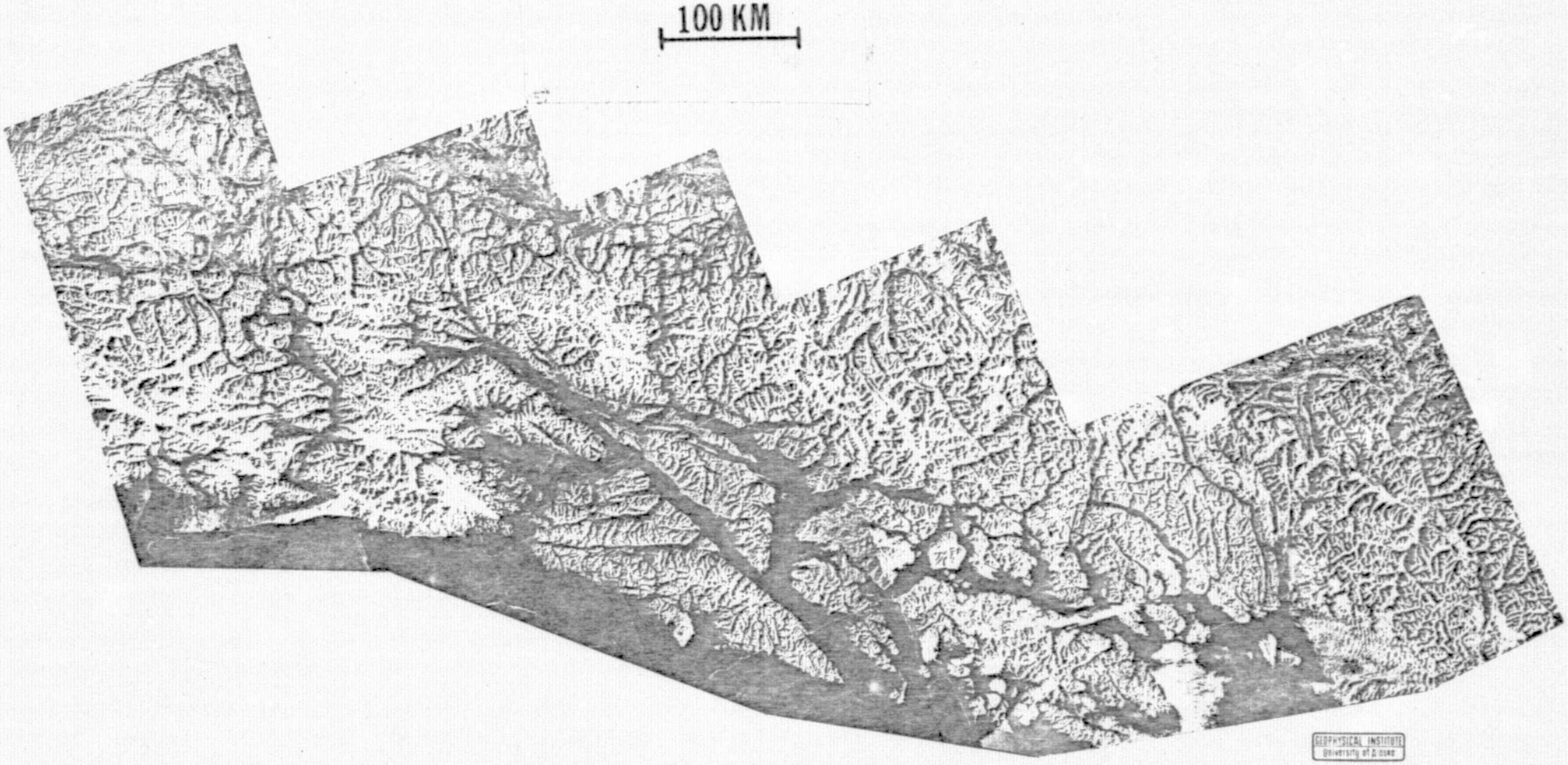


Figure 12. LANDSAT mosaic of southeastern Alaska. As seen in Figure 1, most seismic activity occurs on the Fairweather Faults.

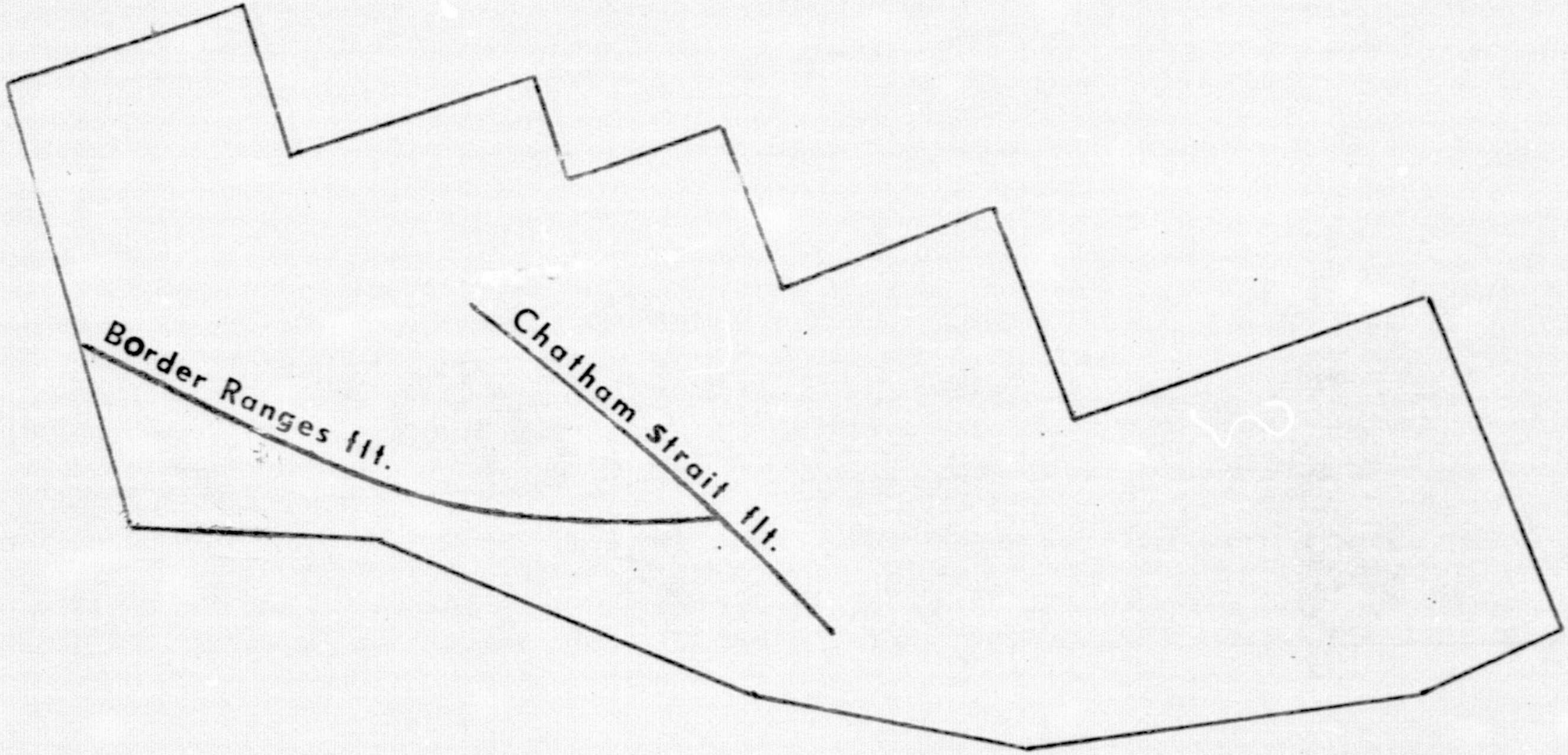


Figure 13. Overlay to Figure 12 identifying the Chatham Strait and southern Border Ranges faults.

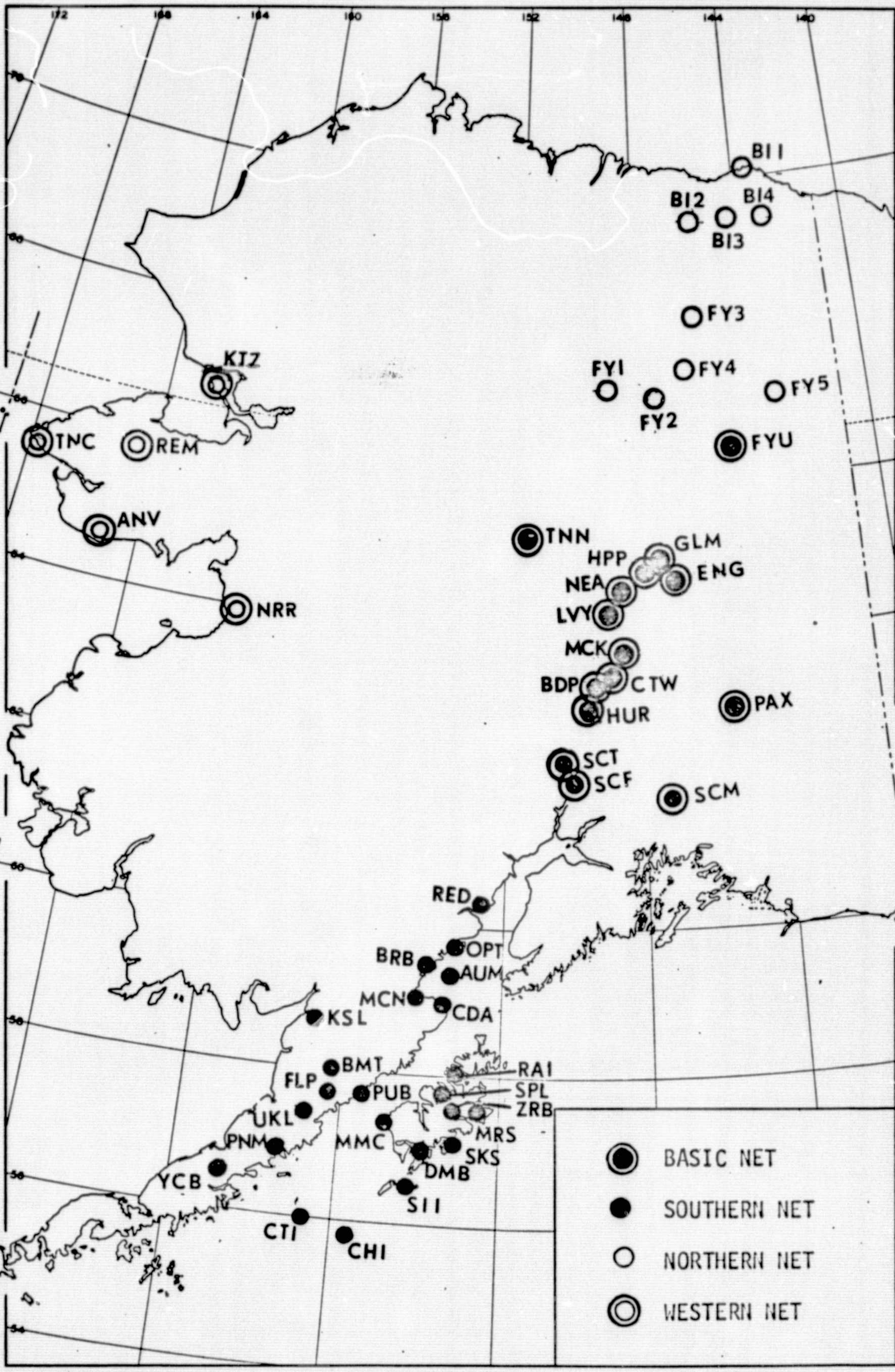


Figure 14. Seismic stations operated by the University of Alaska. The western net was only recently put into operation, the northern net has been in operation for about a year, and the "basic" net for 10 years.

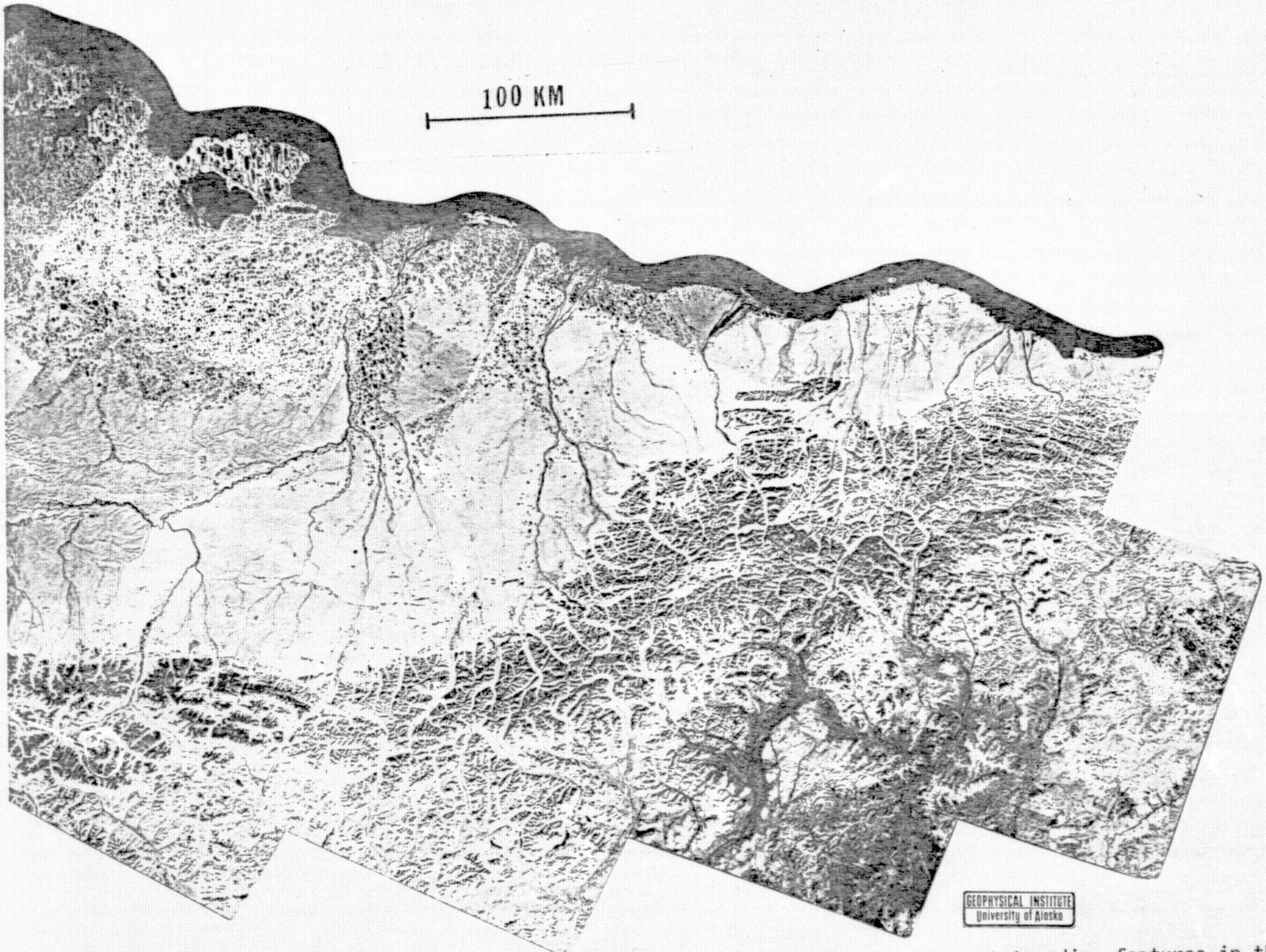


Figure 15a. LANDSAT mosaic of Brooks Range and North Slope. Strong east-west trending features in the Brooks Range are thrust faults. Anticlinal structures can be seen on the North Slope in western part of mosaic.

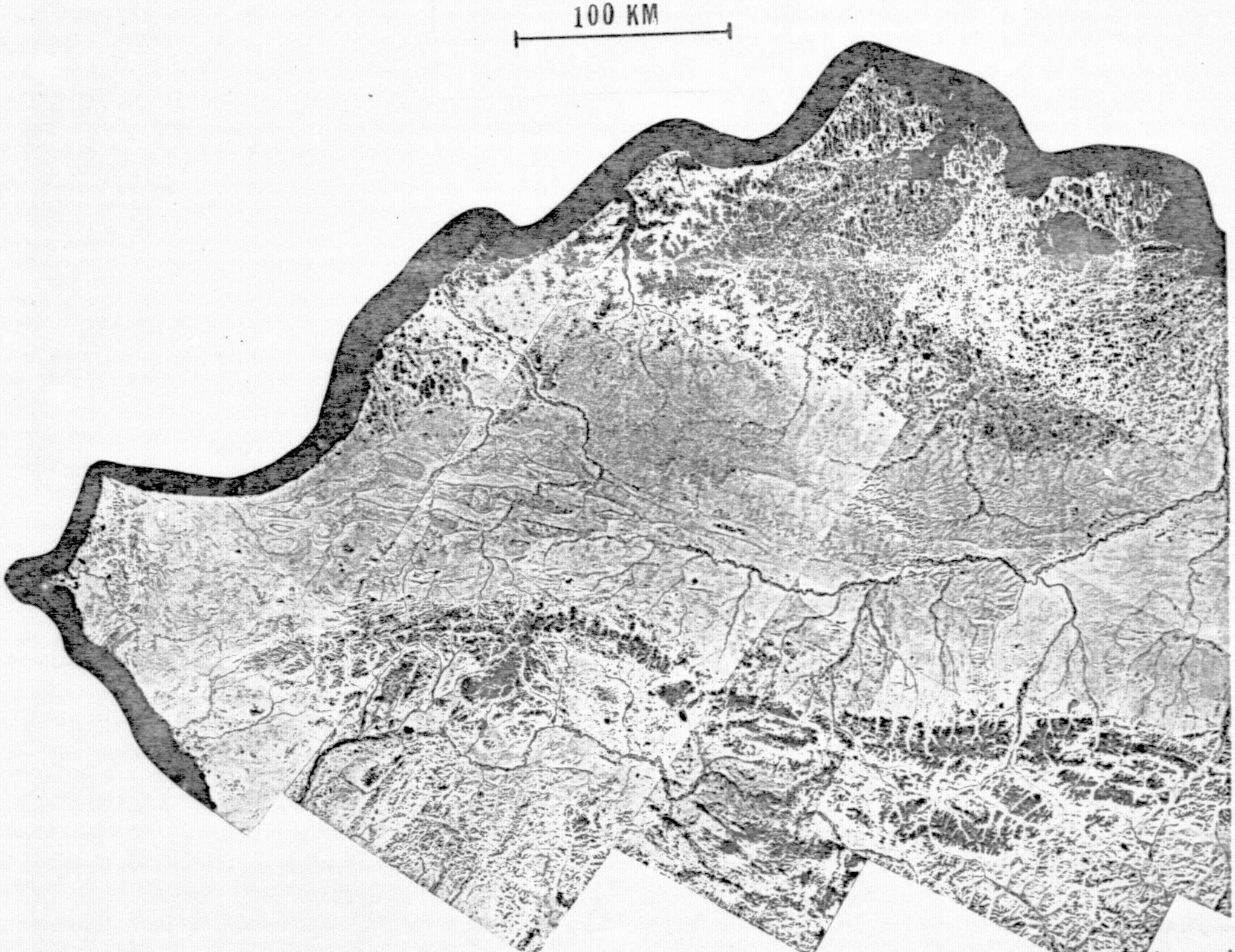


Figure 15b. LANDSAT mosaic of Brooks Range and North Slope. Strong east-west trending features in the Brooks Range are thrust faults. Anticlinal structures can be seen on the North Slope in western part of mosaic.

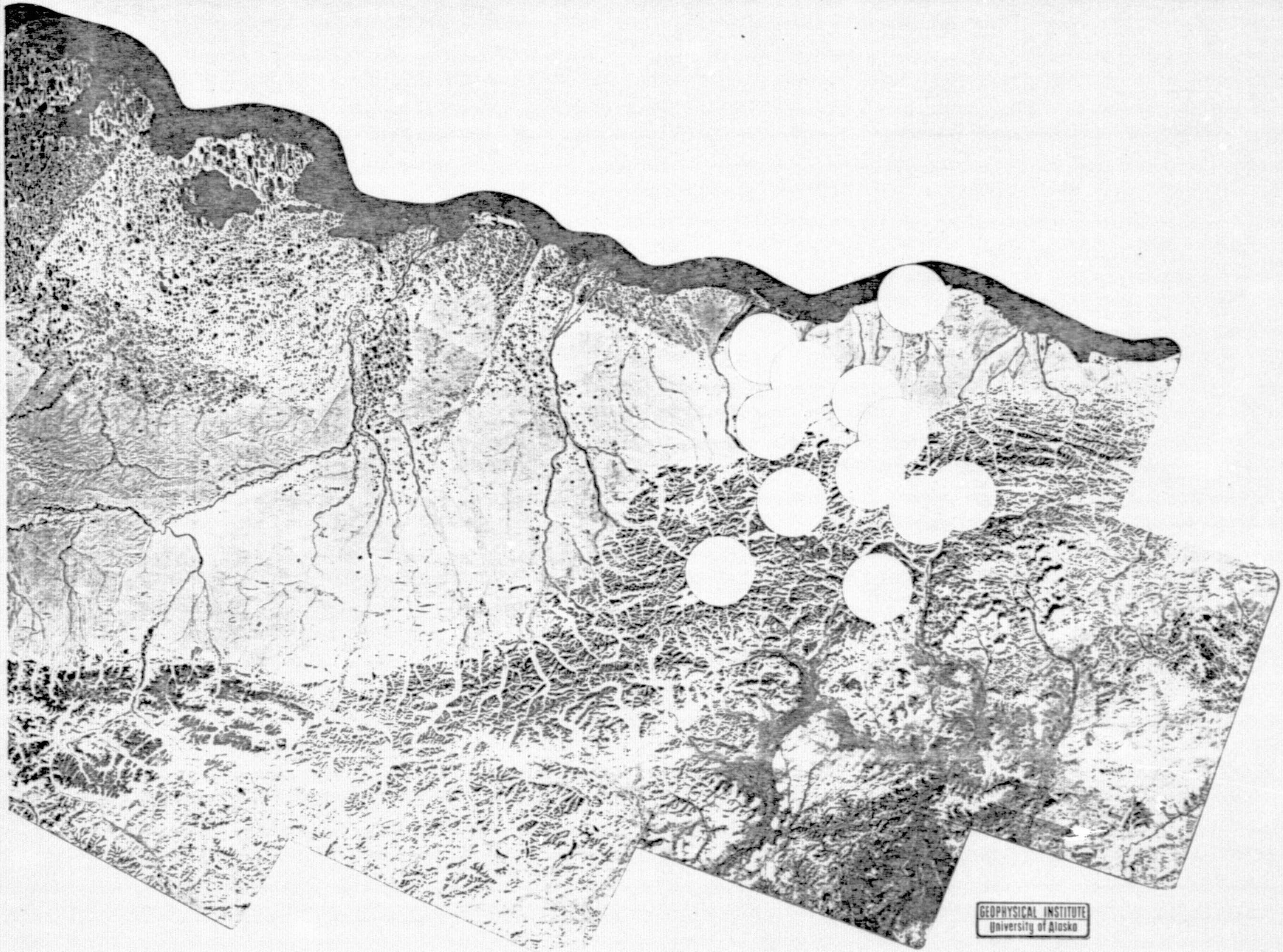


Figure 16. Eastern half of mosaic shown in Figure 15 with epicenters during 1975-76 indicated by circles.

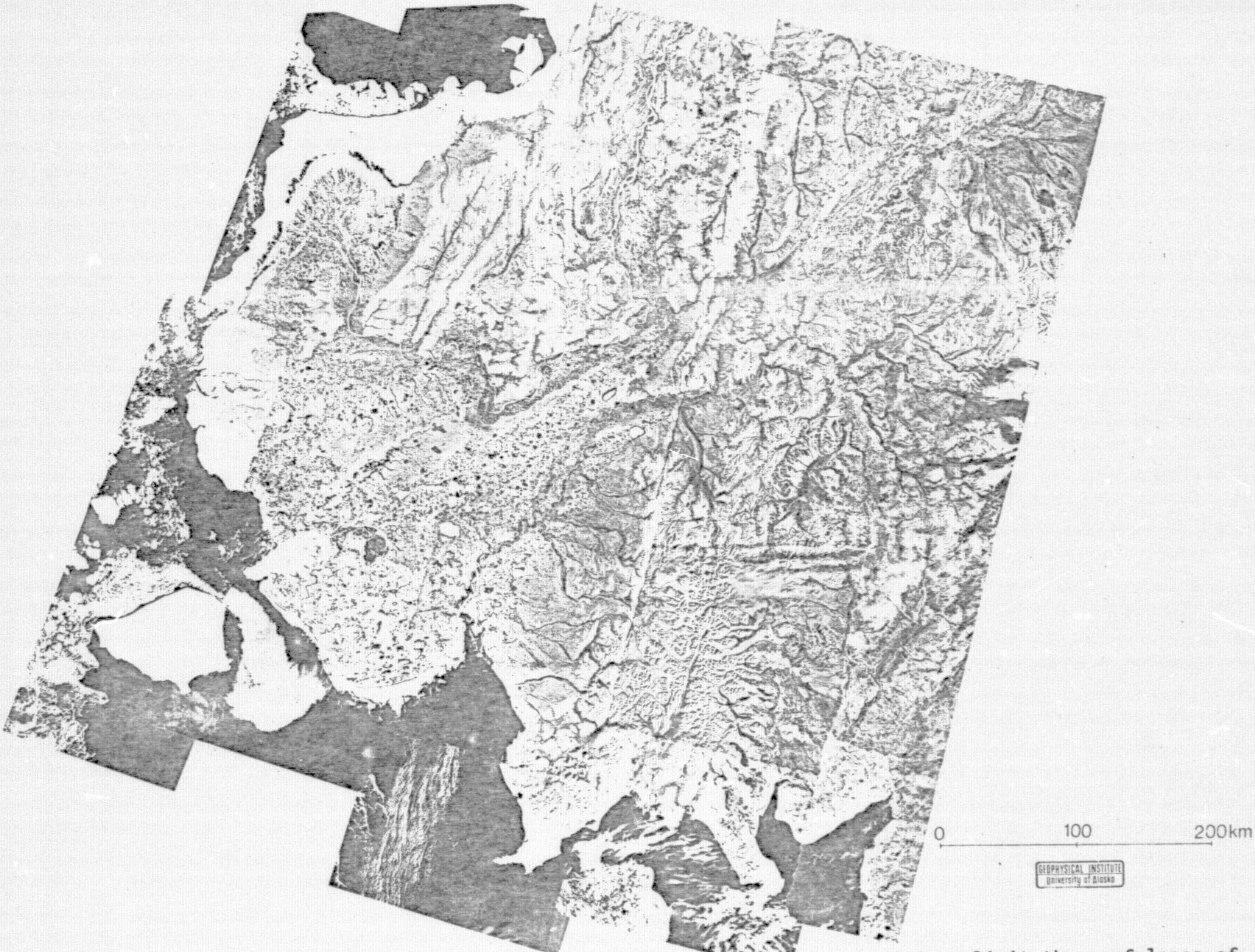


Figure 17. LANDSAT mosaic of western Alaska. Unfavorable climatic conditions limit the usefulness of this mosaic.

Figure 18. Denali fault passing from right center to bottom left. Circular outlines are intrusions. Darker areas at top are forest fire burns.

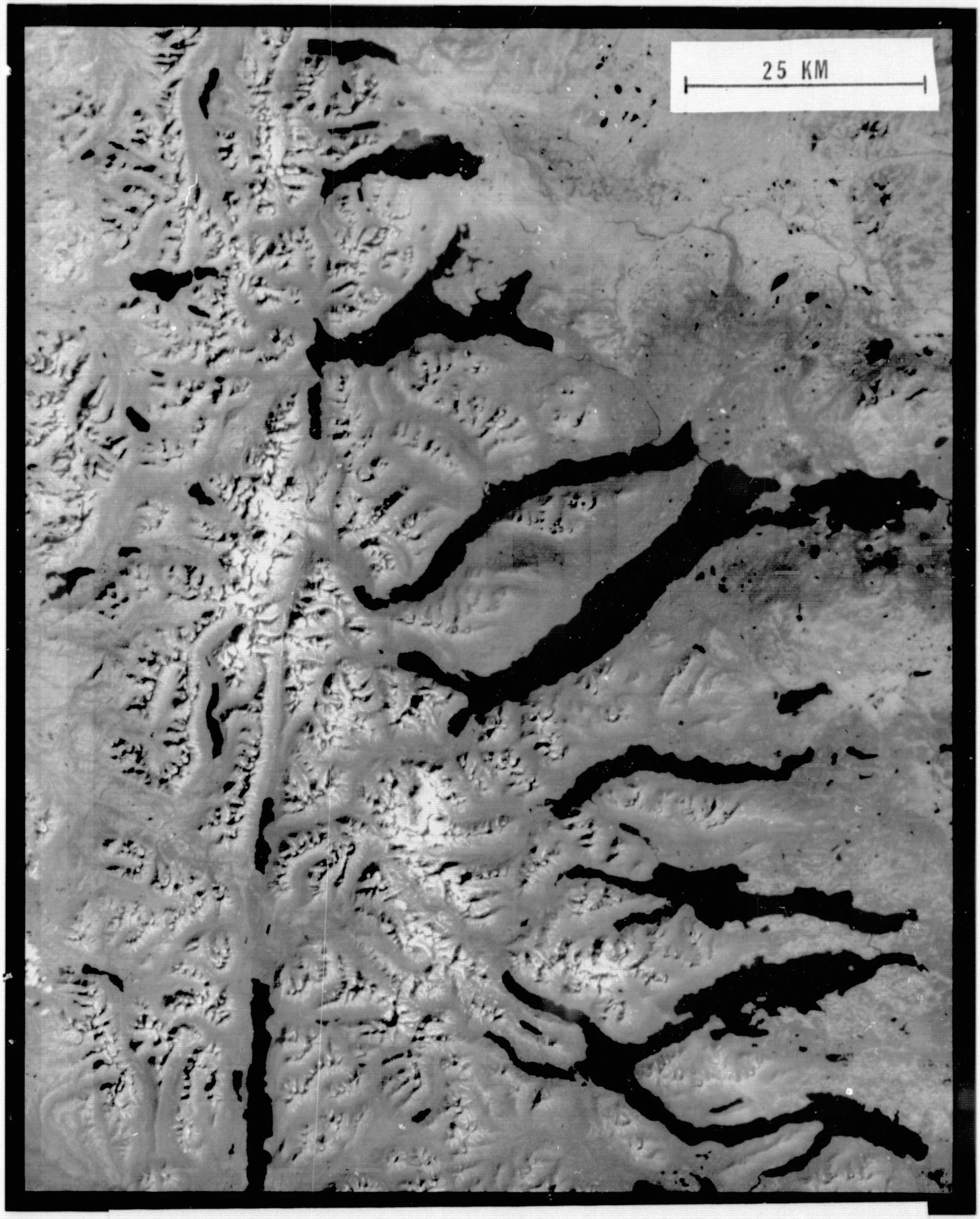


Figure 19. Made south of Fig. 18, Denali fault extends from north to south at left center.

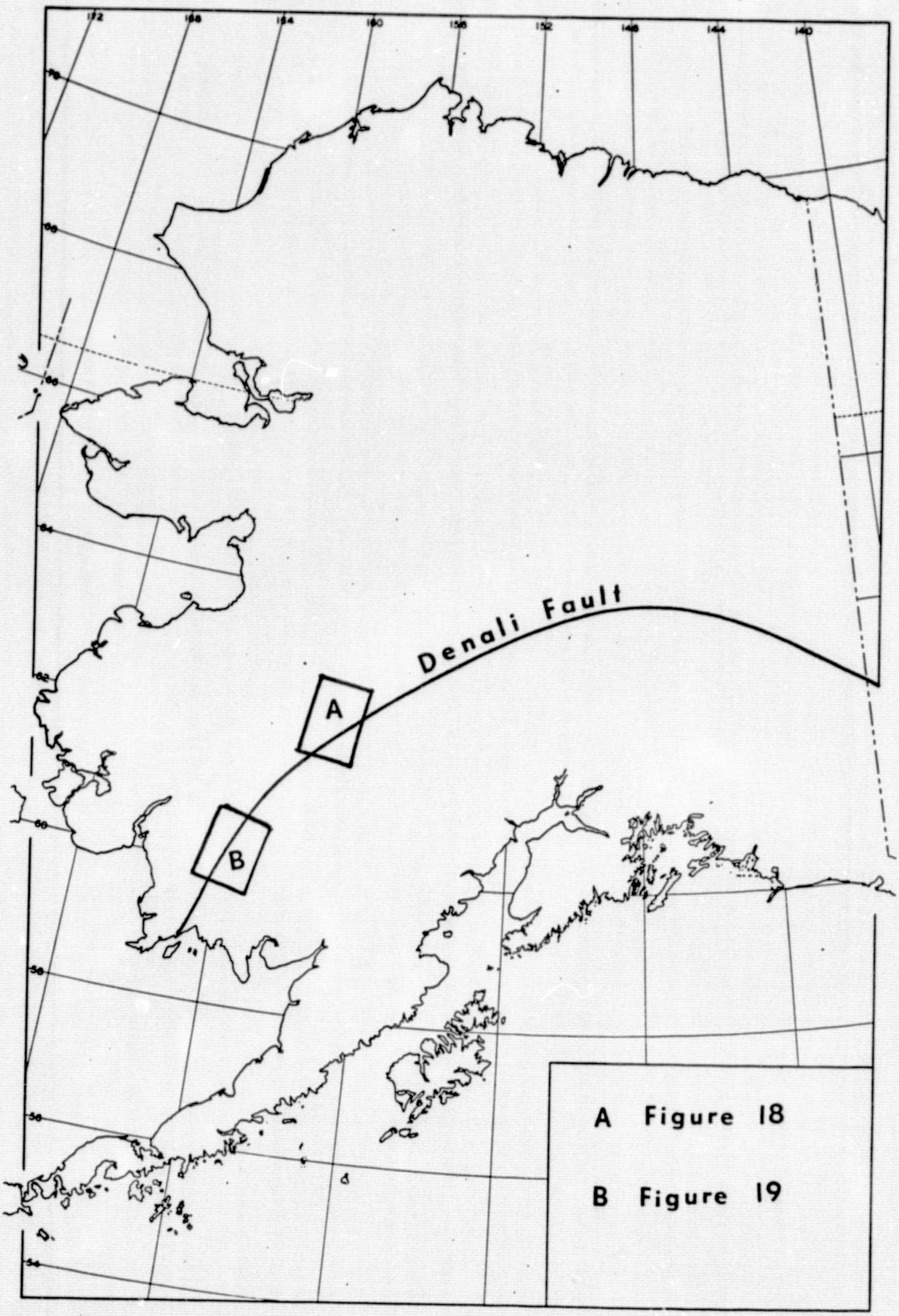
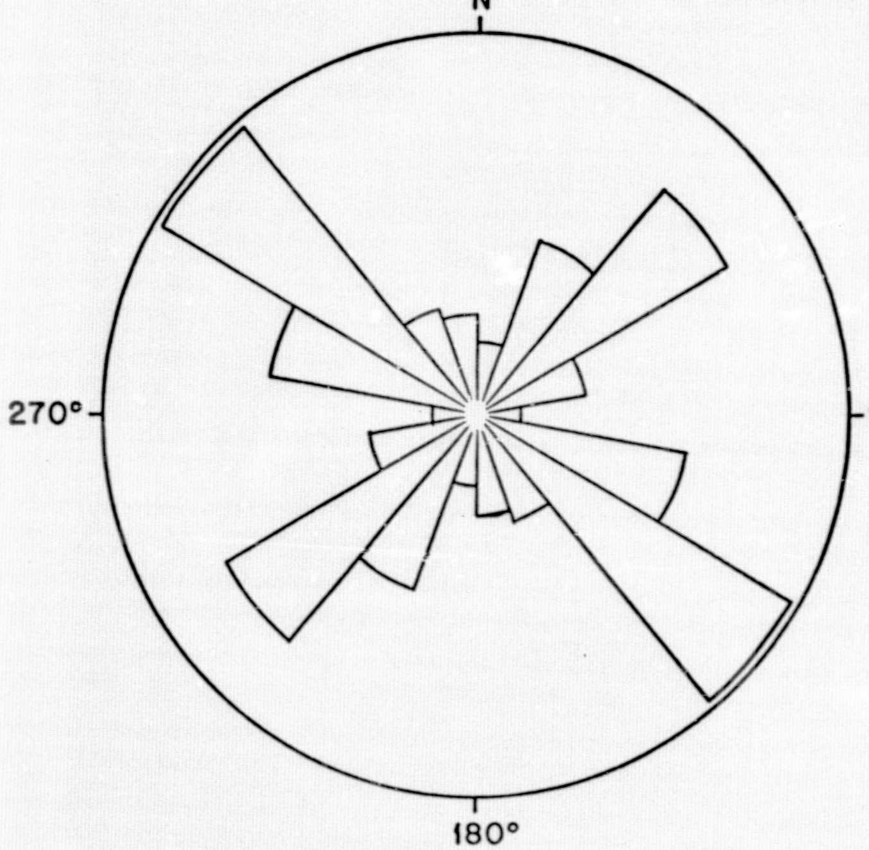


Figure 20. Key to locations of Figure 18 and 19.



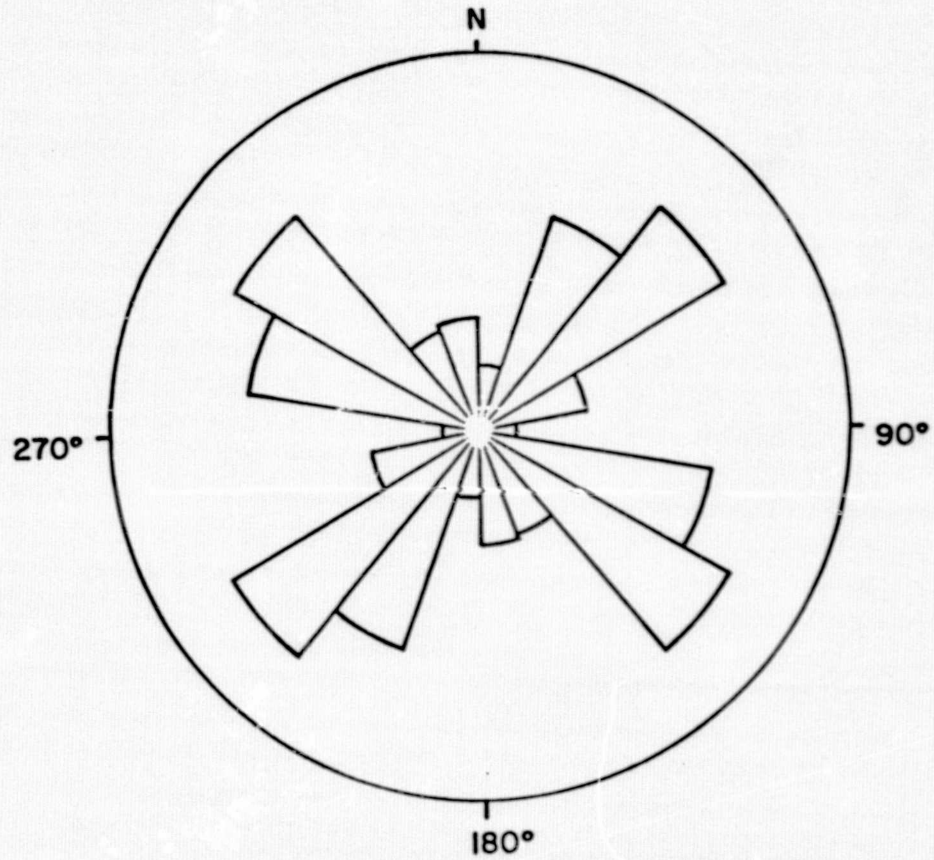


Figure 21. Rose diagrams showing characteristic strike directions of lineaments in the Susitna River area.

Quakes rumble through city

By ERIN VAN BRONKHORST
Staff Writer

Three earthquakes felt in the Fairbanks area early this morning may be part of a pattern of foreshocks before a larger quake, University of Alaska geophysicists indicated today.

"The Interior has had a history of having a fairly large earthquake every ten years, and it's about time again," said Larry Gedney, an associate geophysicist with the Geophysical Institute of the University of Alaska, Fairbanks.

The 1967 earthquake of magnitude 6 caused some damage, Gedney said, largely in stores when things fell off shelves. Some chimneys and foundations were damaged, he said, but there were no injuries.

The three earthquakes early this morning were centered in the Badger Road area, exactly the same place as the 1967 quake, Gedney said. The quakes were: at 1:32 a.m. magnitude 3, at 2:27 a.m. magnitude 4.2, and at 2:34 a.m. magnitude 3.8. No damage was reported, according to Civil Defense Director Jack Murphy.

There were two other tremors earlier this month. On April 16 a quake registered 4.2, centered about 10 miles southwest of Fairbanks, according to Neil Davis of the Institute. On April 25 at 1:12 a.m. a quake registered 3.6, centered about 10 miles southeast of Fairbanks, Davis reported.

All five tremors now appear to be on the same fault, Davis and Gedney said today. In addition, they all probably are on the same fault as the 1967 quake, the scientists added.

The recent quakes cannot definitely be identified as foreshocks, Gedney explained, because foreshocks are not defined until the major earthquake occurs. He said the present series could even be aftershocks from the 1967 quake.

The fault causing the current series runs on a line from Nenana to about three to four miles south of Fairbanks, to Badger Road, to the headwaters of the Chena River, the two men said today.

The Interior does not have huge earthquakes causing great damage as on the southern coast, Davis said earlier, because the rocks on the southern coast are able to accumulate strains in the earth better, and when they crack, the results are greater.

The Good Friday earthquake in Anchorage in 1964 caused extensive damage and took 130 lives. It was registered at 8.4 on the Richter scale. In the series of quakes recorded in the Fairbanks area, none has been above 7.75, and that was in 1904.

In 1937, there was a 7.3 magnitude quake centered between Fairbanks and Mt. McKinley. In 1947, a quake of 7 magnitude was centered north of Mt. McKinley. In 1958 a quake of 6.5 magnitude was centered near Huslia, west of Fairbanks. The 1967 quake, one of a series, registered at 6 and was centered at Badger Road. Another tremor in 1968 registered at 6.8 and was centered near Rampart.

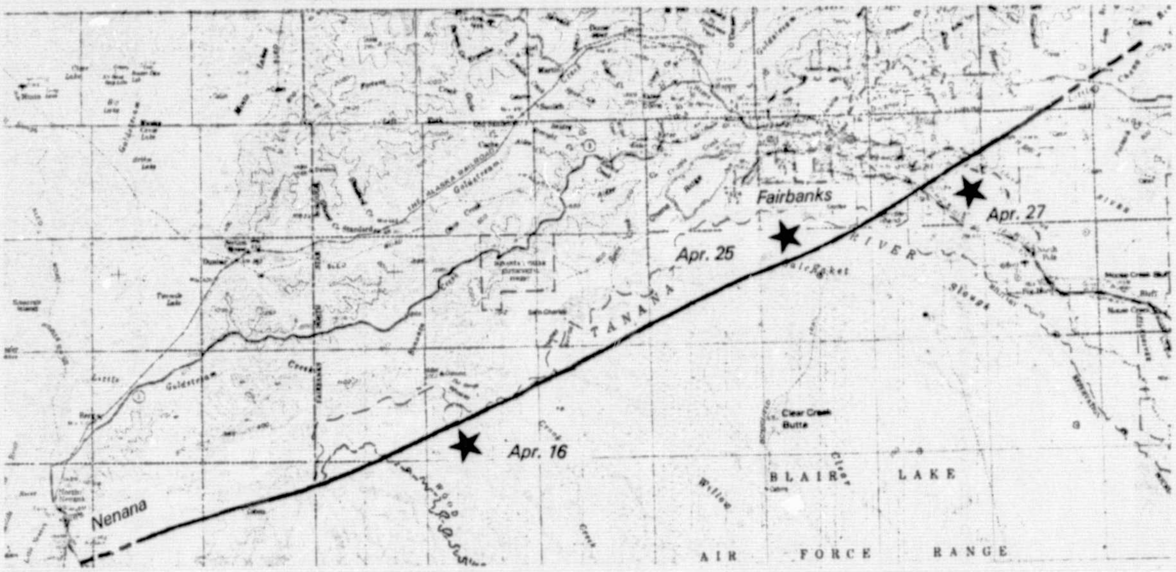
"I'd just tell people not to worry about it. We're going to get earthquakes here in the Interior, we always have, but they're not that bad," Gedney said.

Davis indicated the "only rational sorts of warnings" are about procedures to be followed if an earthquake occurs. The Civil Defense office advises that people inside buildings should stand in a corner, in an interior doorway, or get under a sturdy desk or table. Generally speaking, people are better off staying inside rather than running outside because parts of buildings may fall into the street. However, inside it is a good idea to watch for falling plaster, light fixtures, or items on shelves. Those who are driving cars during a quake should stop in an open area away from tall buildings and stay in the car until the quake is over.

The most important thing is to remain calm and keep thinking.

The only precaution people could take, Davis said, would be to consider the positions of crockery or other breakable items which may be stored on shelves. It would be a good idea to place these somewhere so that they could not fall off and break, he said.

"Even if we think there is going to be a quake, the question is whether it does more harm to tell people about it," he said.



FAULT LINE—The black line shows the location of the line University of Alaska geologists believe is the fault along which the earthquakes of the past week have occurred. It stretches from Nenana to the Badger Road area, the location of Monday night's tremors.

Figure 22. Newspaper clipping reporting on the "Fairbanks fault".